

CLAIMS

What is claimed is:

- 1 1. A solid part, comprising a metallic monolith having a dense core
2 surrounded by a porous periphery.
- 1 2. The part of Claim 1, wherein the porous periphery is characterized
2 by a multitude of interconnected pores.
- 1 3. The part of Claim 2, wherein the porosity varies from more than
2 25% porosity near the surface to less than 5% porosity 100µm or more from the
3 surface.
- 1 4. A solid part, comprising a shaped metallic structure having a dense
2 core surrounded by a porous periphery characterized by a multitude of
3 interconnected pores.
- 1 5. The part of Claim 4, wherein the porosity varies from more than
2 25% porosity near the surface to less than 5% porosity 100µm or more from the
3 surface.
- 1 6. The part of Claim 4, wherein the shaped metallic structure is
2 monolithic.
- 1 7. A solid part, comprising a metallic monolith having a dense core
2 surrounded by a porous periphery characterized by a multitude of interconnected
3 pores.
- 1 8. A prosthesis, comprising:
2 a monolithic metallic substrate having a dense core surrounded by a
3 porous periphery; and
4 a coating of bioactive material on the substrate.

1 9. The prosthesis of Claim 8, wherein the porous periphery is
2 characterized by a multitude of interconnected pores.

1 10. The prosthesis of Claim 8, wherein the bioactive material is
2 hydroxyapatite.

1 11. A prosthesis, comprising:
2 a monolithic metallic substrate having a dense core surrounded by a
3 porous periphery characterized by a multitude of interconnected pores; and
4 a coating of hydroxyapatite on the substrate.

1 12. A dental implant, comprising:
2 a monolithic metallic screw having a dense core surrounded by a porous
3 periphery characterized by a multitude of interconnected pores; and
4 a coating of bioactive material on the screw.

1 13. The dental implant of Claim 12, wherein the metallic screw is a
2 titanium screw.

1 14. The dental implant of Claim 12, wherein the bioactive material is
2 hydroxyapatite.

1 15. A dental implant, comprising:
2 a monolithic titanium screw having a dense core surrounded by a porous
3 periphery characterized by a multitude of interconnected pores, the porous
4 periphery having a porosity that varies from more than 25% porosity near the
5 surface to less than 5% porosity 100 μ m or more from the surface; and
6 a coating of hydroxyapatite on the screw.

1 16. A method, comprising:
2 compacting a metal powder; and

3 exposing the compacted powder to microwaves under conditions sufficient
4 to transform the compressed powder into a monolith having a dense core
5 surrounded by a porous periphery.

1 17. The method of Claim 16, wherein exposing the compacted powder
2 to microwaves under conditions sufficient to transform the compressed powder
3 into a monolith having a dense core surrounded by a porous periphery comprises
4 exposing the compacted powder to microwaves at 1.0 kilowatt - 2.5 kilowatts for
5 not more than 20 minutes.

1 18. A method, comprising:
2 transforming metal powder into a monolith having a dense core
3 surrounded by a porous periphery; and
4 coating the monolith with a bioactive material.

1 19. A method, comprising:
2 pressing titanium powder into a desired shape;
3 exposing the compressed powder to microwaves under conditions
4 sufficient to transform the compressed powder into a monolith having a dense
5 metal core surrounded by a porous metal periphery; and
6 coating the periphery with hydroxyapatite.

1 20. A method, comprising:
2 compacting titanium powder without external heating;
3 microwave sintering the compacted powder to form a substrate; and
4 depositing hydroxyapatite on the substrate.

1 21. A method, comprising:
2 compacting titanium powder without external heating;
3 microwave sintering the compacted powder to form a substrate having a
4 dense core surrounded by a porous periphery; and
5 depositing hydroxyapatite on the periphery of the substrate.

1 22. A method, comprising:
2 compacting titanium powder into a desired shape without external heating,
3 the shape having a core and a periphery surrounding the core; and
4 sintering the compacted powder including heating the core to a
5 temperature greater than the temperature in the periphery.
6

1 23. The method of Claim 22, wherein sintering comprises exposing the
2 compacted powder to microwaves.

1 24. A method, comprising:
2 compacting a metal powder into a desired shape;
3 sintering the compacted powder with microwaves to form a sintered
4 substrate; and
5 electrodepositing a bioactive material on the substrate.

1 25. A method, comprising:
2 compacting titanium particles having a particle size less than 325 mesh
3 into a desired shape;
4 thermally insulating the compacted powder;
5 exposing the insulated compacted powder to microwaves at 1.0 kilowatt -
6 2.5 kilowatts for not more than 20 minutes to form a sintered substrate;
7 electrocrystallizing hydroxyapatite on the substrate; and
8 calcining the coated substrate.

1 26. A method, comprising:
2 compacting titanium particles having a particle size less than 325 mesh
3 into a desired shape;
4 thermally insulating the compacted powder;
5 exposing the insulated compacted powder to microwaves at 1.0 kilowatt -
6 2.5 kilowatts for not more than 20 minutes to form a sintered substrate;
7 washing the substrate in an ultrasonic bath;

- 8 drying the substrate;
- 9 etching the substrate in nitric acid;
- 10 immersing the substrate as an anode in an electrolyte that includes
- 11 $\text{Ca}(\text{NO}_3)_2$, and $\text{NH}_4\text{H}_2\text{PO}_4$;
- 12 immersing a cathode in the electrolyte;
- 13 generating 0.5 to 1.5 amperes of electrical current between the anode and
- 14 cathode for 5-20 minutes to form a coated substrate;
- 15 drying the coated substrate; and
- 16 calcining the coated substrate at 100°C to 400°C .

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